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**REMARKS**

Applicants would like to thank the Examiner for making herself available for the in person interview of September 13, 2005, in connection with the present application. The Applicants have included a Declaration of Allison H. Sampson under 37 C.F.R. §1.132 ("the Sampson Declaration") in connection with this amendment and response.

The Examiner objected to the August 8, 2003 amendment of the specification under 35 U.S.C. §132 as introducing new matter. The sentence objected to by the Examiner has been deleted from the specification and thereby renders the outstanding objection moot. Applicant requests withdrawal of the objection.

The Examiner rejected claims 2-5, 47 and 49 under 35 U.S.C. §112, first paragraph, for failing to comply with the written description requirement. The Examiner requested that the Applicants point out where support in the specification was located for certain claim terms. Applicants traverse this rejection.

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With regard to the rejection of the limitation "in the absence of an anion exchange material" as found in claims 2, and 4, Applicants submit that the limitation has been deleted and renders the rejection moot.

In reference to the rejection of the limitation "...has a pH in the range of about 1.9 to about 2.9" as stated in claim 47, Applicants direct the Examiner's attention to the Sampson Declaration at paragraph 7. According to the Declaration of the inventor, support for the claim limitation can be found in the specification at page 26, line 15 to page 27, line 5, where the specification describes the generation of chlorous acid and chlorine dioxide in the presence of a cation exchange material in the hydrogen form and a catalyst (platinum). Further support for the limitation can also be found in example 7A on page 28, line 13 to page 29, line 4 of the specification.

In addition, Attachment B of the Sampson Declaration, shows a graph supplied by Applicants' cation exchange material manufacturer, Resintech, Inc. (160 Cooper Road West Berlin, NJ 08091), for the CG-8 resin used in the examples in the specification, and which was discussed with the Examiner at the

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interview of September 13, 2005. According to the Sampson Declaration, the starting concentration of the sodium chlorite solutions in Examples 1 - 6 are described on page 16, lines 2 - 4 of the specification, as having a chlorite concentration of 823 mg/L, which is approximately equivalent to 1101 ppm NaClO<sub>2</sub>. As one can see from the graph in Attachment B, the concentration of 1101 ppm NaClO<sub>2</sub> on the Y-axis corresponds to the pH value on the X-axis of about 1.9. Applicants believe that this information clearly shows support for the claim limitation rejected in claim 47.

With regard to the rejection of the limitation "said cation exchange material is selected from the group consisting of...or any of the foregoing" as stated in claim 49, Applicants direct the Examiner's attention to paragraph 8 of the Sampson Declaration. Support for the claim limitation can be found in the specification at page 13, lines 3 - 12. According to the Declaration of the inventor, one of skill in the art would not have read the recited paragraph (page 13, lines 3 - 12) describing the choice of cation and anion exchange materials as being limited to a particular use, only because of the location of the paragraph within the text of the specification. One of

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ordinary skill would have understood that the examples in the recited paragraph were a sample of the cation and anion exchange resins commercially available for any of the processes disclosed within the specification, and not limited to removal of unwanted ions.

Applicants have pointed out to the Examiner support for the foregoing claim limitations and respectfully request withdrawal of the above rejections.

The Examiner rejected claim 51 under 35 U.S.C. §112, second paragraph, for being indefinite. In particular, the Examiner stated, *inter alia*, that the limitation "essentially pure" is a relative term, and the specification did not provide a standard for ascertaining the requisite degree of purity.

Applicants traverse this rejection.

Applicants state that one of ordinary skill in the water purification art would understand that when a dilute sodium chlorite solution (such as 1101 mg/L) is passed through a strong cation exchange column in the hydrogen form, where the column is not exhausted, that conversion of the sodium chlorite to chlorous

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acid is going to be almost 100%. Support for this statement is found in the Sampson Declaration at paragraph 9. In the Declaration, the inventor shows in a graph supplied by Resintech (Attachment C of the Sampson Declaration) that the chlorous acid effluent from the cation exchange column will be essentially a pure chlorous acid solution. Attachment C also shows how much NaClO<sub>2</sub> remains in solution after having passed through CG-8 resin regenerated under normal circumstances. If the CG-8 resin is well regenerated (>90% H), as in Applicants' examples, the effluent solution will have less than 0.8 mg/l NaClO<sub>2</sub> in it when the influent solution is 1000 mg/l NaClO<sub>2</sub>, which also means that the resultant effluent solution is >99% pure. Therefore according to the inventor, one of ordinary skill in the art would understand what the term "essential pure" meant in the context of the specification and claim 51. As such, Applicants request withdrawal of this rejection.

The Examiner rejected claims 2-3 under 35 U.S.C. §102(b) as being anticipated by USP 3,684,437 to Callerame (Callerame '437). The Examiner stated that in Example 9 of Callerame '437, cation exchange material (in the absence of anion exchange material) was shown to convert sodium chlorite solution

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into chlorous acid, although at a greatly diminished efficiency. The Examiner also stated that the anion exchange material disclosed in the examples could be considered as the additive in claim 3 of Applicants' invention, and therefore Callerame '437 anticipates the claimed process. Applicants respectfully traverse this rejection.

As Applicants pointed out to the Examiner during the September 13 interview, the process described in Callerame '437 cannot be the same process as claimed in claims 2-3 of the present invention. The reasons are explained in paragraphs 10-16 of the Sampson Declaration, and are discussed below.

To begin with, Callerame '437 states "Since chlorine dioxide absorbed in water forms chlorous acid from which the gas can be readily expelled by heating, chlorine dioxide and chlorous acid are for all practical purposes, the same thing." This statement is scientifically incorrect. See Attachment D of the Sampson Declaration (Gordon, Gilbert et al., *The Chemistry of Chlorine Dioxide*, S. J. Lippard (Ed.), in Progress in Inorganic Chemistry, Vol. XV, J. Wiley & Sons, New York, 1972, pp. 202-286) which distinguishes acidified sodium chlorite and chlorine

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dioxide. As shown in Attachment D, when the pH of the NaClO<sub>2</sub> is lowered into the range of neutrality as described in Callerame '437 (pH 6.2 - 7.0), Attachment D shows that no ClO<sub>2</sub> is formed by the decomposition of the acidified NaClO<sub>2</sub> when exposed to heat. Furthermore, Applicants clearly distinguish between unstable chlorous acid and chlorine dioxide in their instant invention as not chemically equivalent. Chlorous acid is an ionic species made up of hydrogen cation (H<sup>+</sup>) and chlorite anion (ClO<sub>2</sub><sup>-</sup>) which forms the ionic species HClO<sub>2</sub>. Chlorine dioxide, on the other hand, is a non-ionic dissolved gas in solution, as is shown by its chemical formula in the Species Table of page 97 in Attachment E (The Chlorine Dioxide Handbook, Water Disinfection Series, Cobban, Bill ed. American Water Works Assn. (1998)) of the Sampson Declaration.

In addition, Callerame '437 further states that in order to form chlorous acid (chlorine dioxide by the '437 patent definition), sodium chlorite (NaClO<sub>2</sub>) must be passed through both cation and anion resins in a mixed form. In contrast, according to paragraph 12 of the Sampson Declaration, Applicants' process cannot work if both cation and anion resins are used together in their process. This is because the anion ClO<sub>2</sub><sup>-</sup> would be bound to

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the anion exchange column, and the resulting effluent would be water.

Callerame '437 also teaches that optimal results occur if the pH of the solution is between 6.2 and 7.0, preferably between pH 6.5 and 7.0. In contrast, according to paragraph 13 of the Sampson Declaration, it is impossible using the Applicants' process to make either chlorous acid or chlorine dioxide at this high pH. In contrast, the examples in the present invention show that when Applicants' processes are used to make chlorous acid, it results in a solution with a pH of 1.9, and when making chlorine dioxide solutions it results in a solution with an average pH of about 2.4, before any additional pH adjustment.

The Examiner suggests that Example 9 of Callerame '437, which is a purported control experiment, teaches that conversion of sodium chlorite into chlorous acid using a strong cation exchange resin without the presence of an anion exchange resin as in the earlier examples of Callerame '437. The Examiner admits, however, that the resulting exchanged solution contains only 0.3%  $\text{ClO}_2^-$ , which is approximately a 27% conversion of chlorite,

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compared to the 90% conversion disclosed in other Callerame '437 examples.

Applicants respond that Example 9 does not teach the claimed process of the present invention for the following reasons. First, in addition to  $\text{ClO}_2^-$  ion, the '437 patent shows the presence of  $\text{OCl}^-$  ions (0.3%) and  $\text{HCl}$  (0.3%) which cannot occur in Applicants' process. Applicants' claimed process requires the direct exchange of  $\text{Na}^+$  ions with  $\text{H}^+$  ions using only a cation exchange resin. This is illustrated in equations describing the chemical processes occurring within the cation exchange resin of Applicants' invention in Attachment E, of the Sampson Declaration, as provided by ResinTech. As shown in the equations of Attachment E, there can be no conversion of  $\text{ClO}_2^-$  ion, and 100% of  $\text{ClO}_2^-$  ion going into the column leaves as  $\text{ClO}_2^-$  ion. Second, it is chemically impossible for the  $\text{ClO}_2^-$  ion in the process of the present invention to be converted at any concentration, to  $\text{OCl}^-$  or  $\text{HCl}$ . Third, the inventor in Callerame '437 reports the same pH of the product solutions even when he increases the concentration of sodium chlorite to 2%, which does not correlate with the cation exchange characteristics of the cation resin, as demonstrated in the graph depicted in Attachment

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B (which shows 832 ppm ClO<sub>2</sub>) correlates to about a pH of 2 at anywhere from 90-99 H<sup>+</sup> on the resin). Therefore, one of ordinary skill in the art would conclude that the actual process used in Callerame '437 cannot be the process claimed in the present invention, and therefore it cannot anticipate claims 2-3. Applicants request withdrawal of this rejection in view of the foregoing.

The Examiner rejected claims 4-5 under 35 U.S.C. §102(b) as being anticipated by USP 3,828,097 to Callerame (Callerame '097). The Examiner states that Callerame '097 discloses a process for making chlorous acid by flowing an aqueous solution of a metal chlorate and a nitrite through a cation exchange resin which is in the hydrogen form. The Examiner has asserted that the nitrite element can be considered to be the "additive" as claimed in claim 5. Applicants respectfully traverse this rejection.

Applicants respond to this rejection by stating (as in the previous rejection in view of Callerame '437) that the process taught by Callerame '097 cannot be the same process as disclosed and claimed in Applicants' present invention for the

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following reasons. First, as with Callerame '437, the inventor in Callerame declares that chlorous acid and chlorine dioxide are the same thing, which one of skill in the art would understand to be scientifically incorrect (Sampson Declaration, paragraph 11, and Attachment D). Second, the claimed process of the present invention does not use nitrite or any other reducing agent to mix with the sodium chlorate prior to elution through the cation exchange column (Sampson Declaration, paragraph 17). Third, the term additive would be understood by one of skill in the art to be an insoluble substance added to the cation exchange resin while in the dry or moist form prior to use in the claimed process. As shown in Example 1 of the '097 patent, the sodium nitrite is added to the metal chlorate solution prior to passing it through the cation exchange column. As such, one of skill would not understand sodium nitrite to be an additive as that term is commonly used by one of skill in the relevant art (Sampson Declaration, paragraph 17). Fourth, the inventor of the '097 patent shows in Example 1, that the pH of the initial solution is 9 and then acid must be added for the conversion to occur. No acid is added to the metal chlorate solution prior to its elution onto the column in the Applicants' invention. The only source of H<sup>+</sup> ions is from the cation exchange column.

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In summary, one of ordinary skill in the art would readily understand that the process taught in the '097 patent is not at all the same as the process claimed in claims 4-5 of the present invention, and therefore the '097 patent cannot anticipate the claimed process of the present invention (Sampson Declaration, paragraph 17). As such, Applicants respectfully request withdrawal of this rejection.

The Examiner rejected claims 2-3, 51 under 35 U.S.C. §103(a) as unpatentable over Callerame '437. According to the Examiner, Callerame '437 teaches that in the absence of an anion exchange resin a poor yield of chlorous acid is obtained and the resulting chlorous acid is not pure and rapidly deteriorates. Thus it would have been obvious to one of ordinary skill to eliminate the use of the anion exchange resin along with its attended function. Applicants traverse this rejection.

Applicants have shown in their previous remarks, that Callerame '437 is not a proper §102(b) reference, as it clearly does not teach the same process for making chlorous acid as disclosed and claimed by Applicants. Thus Callerame '437 cannot

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be properly used to show that the Applicants' claimed process is unpatentable as obvious.

Notwithstanding the fact that Callerame '437 is not a proper §102(b) reference, the Examiner argues that it would have been obvious for one of skill in the art to eliminate the use of the anion exchange resin as taught in Callerame '437 to arrive at Applicants' claimed process. Applicants respond that it would not have been obvious to one of ordinary skill in the art, when looking at the prior art and Callerame '437, to combine the elements as described in Applicants' invention because the prior art, including Callerame '437 itself, teaches away from such combinations (Sampson Declaration, paragraph 19).

The Examiner has presented no line of reasoning as to why one of skill in the art, when reviewing the art, would have found it obvious to selectively pick and choose the various elements and/or concepts of Callerame '437 to arrive at the claimed process. Anyone of skill in the art reading Callerame '437 would believe that the anion exchange resin was absolutely necessary to obtain any chlorous acid. Examples 1-3 in Callerame '437 show conversion rates of chlorite to chlorous acid

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(described as "ClO<sub>2</sub>") in the range of 80-90%, where Example 9, without anion exchange resin shows a 27% conversion rate (Sampson Declaration at paragraph 14).

In the present Office Action, the Examiner has only cited Callerame '437 to show elements of the claimed invention in one or more combinations without addressing the suggestion or motivation in the art to do so. See Ex parte Clapp, 227 U.S.P.Q. 972 (B.P.A.I. 1985). Moreover, the mere fact that a device or process utilizes a known scientific principle does not alone make that device or process obvious. See, Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1053, 5 USPQ2d 1434, 1440 (Fed. Cir. 1988). See also, Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 730 F.2d 1452, 1462, 221 USPQ 481, 489 (Fed. Cir. 1984).

Specifically, there is nothing in the cited prior art or Callerame '437 which either teaches or suggests Applicants' process of converting sodium chlorite into chlorous acid. In view of the foregoing, Applicants respectfully request withdrawal of the rejection.

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The Examiner rejected claims 2-3, 42 and 51 under 35 U.S.C. §103(a) as unpatentable over Callerame '437 in view of USP 5,100,652 to Kross et al. (Kross '652). The Examiner admits that Callerame '437 does not teach the step of contacting chlorous acid with a catalytic material to obtain chlorine dioxide. However, the Examiner asserts that Kross '652 teaches that compounds having vicinal hydroxyl groups can catalyze chlorous acid into chlorine dioxide, and that the combination of the two references would have been obvious to one of ordinary skill in the art because chlorine dioxide formed by such a method can be used as an oral disinfectant. Applicants traverse this rejection.

As Applicants have stated with regard to Callerame '437 previously, Applicants have shown that Callerame '437 is not a proper §102(b) reference as it clearly does not teach the same process for making chlorous acid as disclosed and claimed by Applicants. Thus Callerame '437 cannot be properly used to show that the Applicants' claimed process is unpatentable as obvious to one of ordinary skill in the art, either alone or in combination with Kross '652.

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With regard to Kross '652, the Examiner has cited the reference as teaching that acids and sugars with vicinal hydroxyl groups could be used as a catalyst as claimed, *inter alia*, in claims 42, and 43, to convert chlorous acid to chlorine dioxide.

According to the Sampson Declaration, one of ordinary skill in the art would understand, from a careful reading of the specification of the present application, that the catalysts used to convert chlorous acid to chlorine dioxide in the present invention, are insoluble substances which can either be mixed with the ion exchange material prior to use, or deposited on various substrates prior to use. In no case does the catalytic material used in the reactions of Applicants' invention become part of the effluent chlorous acid product (See, Sampson Declaration at paragraphs 18-19).

In contrast, in Kross '652, the sorbitol, or malic acid is added to the product prior to its use and becomes part of the end product. Applicants clearly state at page 12, lines 1-9 of the present specification, that many catalysts that can be used within the scope of the present invention. These include, but are not limited to platinum, palladium, manganese dioxide,

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carbon, and other known ion exchange materials. Further, it is well known to those of ordinary skill in the art, that depositing such catalysts on various substrates, such as zeolites, aids in the catalysis by increasing surface area. Such catalysts are commercially available, and it is within the scope of those skilled in the art to choose an appropriate catalytic material and/or substrate to catalyze chlorous acid to chlorine dioxide. As such, one of skill in the art would not consider compounds having the vicinal hydroxyl groups as described in Kross '652 to be with the scope of the catalysts encompassed in the present invention (See, Sampson Declaration at paragraphs 18-19).

The Examiner also rejected claims 4-5, and 43 under 35 U.S.C. §103(a) as unpatentable over Callerame '097 in view of Kross '652. The Examiner admits that Callerame '097 does not teach the step of contacting chlorous acid with a catalytic material to obtain chlorine dioxide. However, the Examiner asserts, as in the previous rejection, that Kross '652 teaches that compounds having vicinal hydroxyl groups can catalyze chlorous acid into chlorine dioxide, and that the combination of the two references would have been obvious to one of ordinary skill in the art because chlorine dioxide formed by such a method

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can be used as an oral disinfectant. Applicants traverse this rejection.

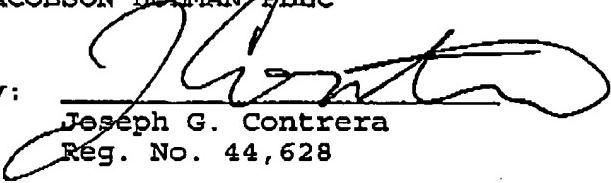
Applicants request that the rejection of claims 4-5 and 43 be withdrawn for the same reasons as set forth in Applicants' response to the rejection of claims 2-3, 42, and 51 discussed previously.

All of the stated grounds of rejection have now been properly traversed, accommodated, or rendered moot. It is believed that a full and complete response has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. Should Examiner Nguyen have any questions or believe an interview would expedite prosecution of the instant application, she is requested to telephone undersigned counsel.

Respectfully submitted,

JACOBSON HOLMAN PLLC

By:

  
Joseph G. Contrera  
Reg. No. 44,628

400 Seventh Street, N.W.  
Washington, D.C. 20004  
(202) 638-6666  
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HBJ/JGC/gm